Menlo Park Notebook #33 [N-79-01-00]

There are no dated entries in this notebook. The book probably dates from 1879. Most of the entries are by Francis Upton. There are also entries by Edison and Charles Batchelor. The material by Upton consists of notes, drawings, and calculations relating to electric lighting costs, lamp and generator tests, generator design, and electric power distribution. The material by Edison includes calculations and drawings of regulators, notes on tests with an electric engine, and calculations relating to lamps. There are also notes by Batchelor on tests of a small dynamo and notes by an unknown laboratory assistant on experiments to determine the conductivity of various substances. The book contains 282 numbered pages.

Blank pages not filmed: 208-211, 270, 273.

Missing page numbers: 271-272.

No 83.

LIBRARY OF THE

BOARD OF PATENT CONTRO

120 BROADWAY, NEW YORK.

_____, 189

(141) 1 1

Cinbolite Ag (Cl Br.) Silver City New Mexico

No indication

(386)

Chabazite

no current

19 Allemontite Sb. As.

It offers no resistance

184 Hercynite

no current

179 Corundum Al.

no current

198 Uraninite Pitchblende

when I pressed down with my fingers I got a resistance of about 20 ohms. When I put it in the clamps and

2 brought it down to about 14 ohms. I pressed it down again with my fingers and it gave hardly any resistance this time which is perhaps due to the moisture coming on one side.

231 Blendeite
no Current

Galena (n B. 15
no Current

217 Earthy Cobalt
no Current

34 Pyrolusite
no Current

293 Arsenic Mispickel
no Current

1 Gold Ore
no Current

231 Quartz Smoky
no Current

247 Bytownite
no Current

204 Hatchite ? ?
no Current

271 Van Rensselaerite
no Current

203 Diaspore
no Current

054 Kupfernickel
no Current

3

171 Aegirite Magnetic Ore
no Current

22 Sulphur
no Current

237 Wollastonite
No Current

55A Wavellite
No Current

415 Samarskite
no Current

58 Pyrite
No Current

321 Amethyst
No Current

718 Magnesite + Hypomagnesite
no Current

183 Spinel
no Current

69 Braunerite
no Current

98 Sylvanite no current

47H Columbite no Current

192 Cassiterite no Current

231 Quartz
No Current

386 Chabazite
And current

178 Samarskite
No Current

175 Columnite
no Current

346 Chrysocolla
no Current

401 Cyprite
no Current

351 Datolite
no Current

49 Horseflesh Ore

when pressed with the hand it gave a resistance of about .12 ($\frac{12}{100}$) of an ohm with the clamps it went down to about .99 ($\frac{99}{100}$)

225 Stibiconite

when pressed with the hand it gave a resistance of about .2 ($\frac{2}{10}$) of an ohm. when with the clamps it went to .12 ($\frac{12}{100}$) of an ohm

87 Allemanite

When pressed down with the hand it gave a resistance of about .07 ($\frac{7}{100}$) with clamps a little less.

186 Loadstone

with Clamps it gave a resistance of about .4 ohms

17 Arsenic

when pressed with the clamps it gave a resistance of .08 ($\frac{8}{100}$) of an ohm.

83 Smaltite

Gave a resistance of about .06 ($\frac{6}{100}$)

64 Cinnabar
[illegible] gave a resistance of about 700 ohms

198 Smaltite
one piece gave me a resistance of about 200 ohms & another [illegible]

222 Figure Stone
no Current

269 Garnet
no Current

474 Uvarovite + 290 Lepidomelane
no Current

29 Stilbite It looks as if it had a metal, but gave it [illegible]
no Current

447 Jeffersite
no Current

716 Dolomite
no Current

610 Wolframite
no Current has the looks of a metal + is heavy

10.

231 Staurolite
no Current

H01 Hypersthene
no Current

205 Limonite
no Current

2[illegible] Mica Group
no Current

798 Iron Oxide
no Current

422 Aggimatolite
Kaolin
no Current

[illegible] Magnetic Ore
no Current

38H

Schorlomite
no Current

It comes as effect were as ore for is heavy.

272 Zircon
No Current

231 Agate
no Current

551 Magnetite
no Current

678 Pleonaste
no Current

193 Rutile
It is heavy and looks like a metal, but gives no current.

Graphite
No Current

Hematite
No Current

Ferromonite
No Current

Azurite
No current

Cerrusite
No Current

Pennimite
No Current

Pyromorphite
No Current

227 Cervantite

I got a deflection, but could not measure the resistance it being above 100000 ohms.

2 Silver (Lake Superior)

I got a resistance of about .01 ($\frac{1}{100}$) of an ohm

276 Epidote

Got a deflection, but resistance above 1000 ohms

178. Melaconite

Got a deflection, but resistance above 100000 ohms.

21 Tellurium native

gave resistance of about 1000 ohms.

40 Marcasite
about 4000 ohms resistance

44 Cubanite
about 1/5 of an ohm resistance

122 Boulangerite
about 150 ohms

No Current

458 Enargite
No Current

916 Orthoclase
No Current

838 Grahamite
No Current

278 Idaite
No Current

153 Hessite
On some parts of the surface when I apply my wires to it gives hardly no resistance while there are parts where I cannot get any current at all.

56 Sphalerite
No Current

715 Calcite
No Current

584 Vivianite
No Current

125 Dimagnetite

Dr gave me a resistance of about 2½ ohms.

125 Tetrahedrite

gave resistance of about 250 ohms on some spots, while more or less on other parts

97 Protoferriumcilite
no current

293 Muscovite
no current

558 Phyllite
no current

247 Amphibole
no current

320 Mica
no current

400 Talc
no current

710 Garhofite

891 Jet no current

1115 Halite
no current

724 Aragonite
no current

6514 Gypsum
No Current

715 Celestite
no Current

916 Cabonate
no Current

44 Hematite
Dr gave a resistance of about .08 of an ohm.

81 Limonite
Dr gave a resistance of about .1 of an ohm. Dr seems to be borne out.

91 Leucopyrite
Dr gave me a resistance of about 3 ohms.

64 Cinnabar
Dr gave me a resistance of about 400 ohms

916 Orthoclase (Red)
no Current

715 Calcarious Tufa
no Current

186 Magnetited muscovite
no Current

999 Talc
no Current

271 Garnet
no Current

420 Hallingite
Put a dot on the [illegible]

4

4 Elmore Mountain Rock
no Current

247 Amphibole
no current

231 Quartz (Rose colored)
no Current

715 Calcite Ca C
no current

749 Hydrozincite
no Current

181 Manganaxinite
no Current

276 Epidote
do Current

231 [illegible]

[illegible]
no Current

631 Celestite
do Current

715 [illegible] Ca C
gives no current tests
here & there [illegible]
of Tinnacite Lead with Cu dust
Crystals

232 Opalized Wood
no Current

291 Garnet
no Current

231 Petrified Wood
no Current

30 [illegible]
no Current

205 Tourmaline
no current

285 Anthracite
no Current

73 [illegible]
no Current

3 [illegible]
no Current

Othoclase
no Current

5H Phonolite (Cap)
no Current

5b Ca[illegible]
Dog below cap
no current

10 [illegible]
[illegible]

157 Smelt [illegible]
[illegible]

210 Glaucophane
[illegible]

269 Cyanite
[illegible]

322 [illegible]
no current

263 Hulfenite
no Current

5

189 Corundum
no Current

236 Delevitz
no Current

275 Calcite (Carb)
no Current

419 Kassiterite

23 Agalmyd (wood)
no Current

217 Heulandite
Current

411 Antillite
no Current

184 Cu[illegible] Pachysandra Kaempferiae
.. No Current

185 Nop[illegible]
No Current

186 Bienaeeantha
No Current

2[illegible] [illegible]
no Current

168 [illegible]
no Current

212 Calorastrobe
no Current

16 Dolomite
no current

[illegible] Empororial Exile
No Current

[illegible] Nephrite
no current

188 Frankenstone
no current

[illegible]

237 [illegible]
[illegible]

256 [illegible]
no current

59 [illegible]

45 [illegible]
no current

183 Euphrosite
no current

71 Bronzite
no current

102 [illegible]
no current

66 [illegible]
no current

181 [illegible]
No Current

218 [illegible]
No current

68 [illegible]
No Current

197 [illegible]
No current

64 Hematite (Fe$_2$)
Gave a resistance of
about 1414 ohms

106 Graphite (C)
It offered hardly no
resistance.

113 Cyprite
It offered [illegible]

Cuprous [illegible]
It gave a resistance
of about [illegible] ohms

77 Zincite
It gave me a resistance
of about 240 ohms.

32

33

176 Amalgames

191

bb

50-

193 Laboratoire

194 Institut

106 Bismuth

7 Limestone
no Current

283 Chalk no Current

24# Flint
no Current

17 Basalt, Diorite &c
no Current

95 Andesite
no Current

Calcareous Grit
no Current

14 Sphaerulite
no Current

190 Arragonite
no Current

11 Quartz (Calcareous)
no Current

(a) Channel Grit
no Current

14 Quartz
no Current

6 Quartz
Clear Crystal
no Current

63 Granite
no Current

26 Perroquet

281 Sirène Quartier

14 [illegible]
Eyre
[illegible]

142 Hématite
No Current

144 Amphibolite

52 Calcaire
No Current

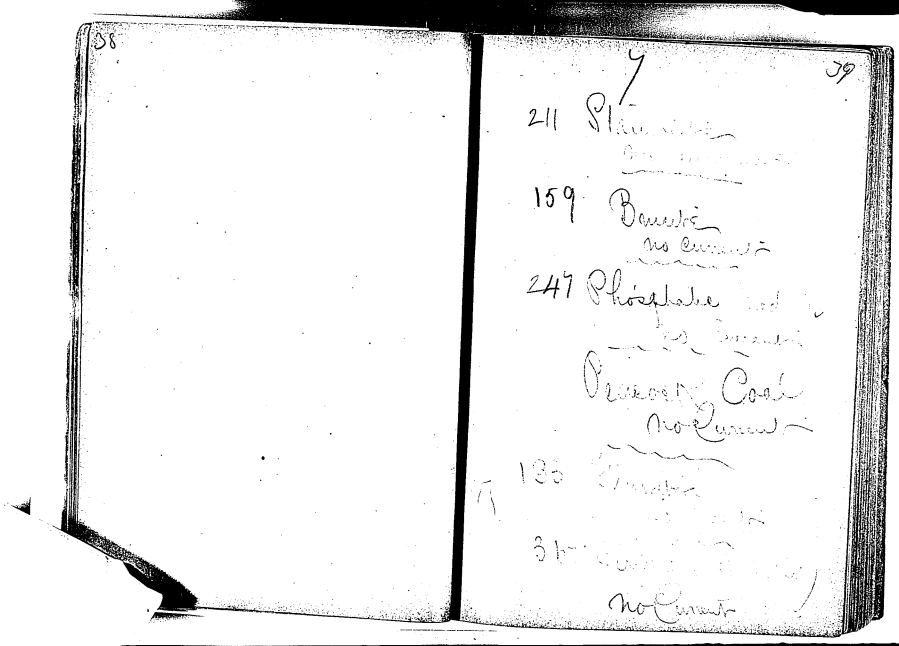
44 Chrysocolla
[illegible] Current

206 Tourmaline
[illegible] Current

98 [illegible] (Cuesta Co.)
[illegible]

459 It offered for a short
[illegible]

243 Seybertite
It is [illegible]
Have [illegible] graphite +
Cannot get a current
through it — doesn't



215 Chabazite
No Current

247 Prehnite
No Current

51 Barite
No Current

131 Fluorite (Ca F)
No Current

314 Diopside
No Current

139 Calcite Ca C
No Current

214 Chabazite
No Current

300 Diabantite
No Current

188 Biotite
No Current

187 Amphibole
No Current

Cossyrite
(Var Augite)
No Current

222 Glauconite
No Current

273 Calcite
(Needle head Spar)
No Current

286 Magnesite
No Current

280 Calcite
[illegible] no Cimetière

202 Craquelé
du Cimetière

185 Marneux
du Cimetière

816 Schisteux
du Cimetière

200 Marneuse
du Cimetière

191 Marneuse
du Cimetière

45 Calcaire ou Pierre
[illegible]

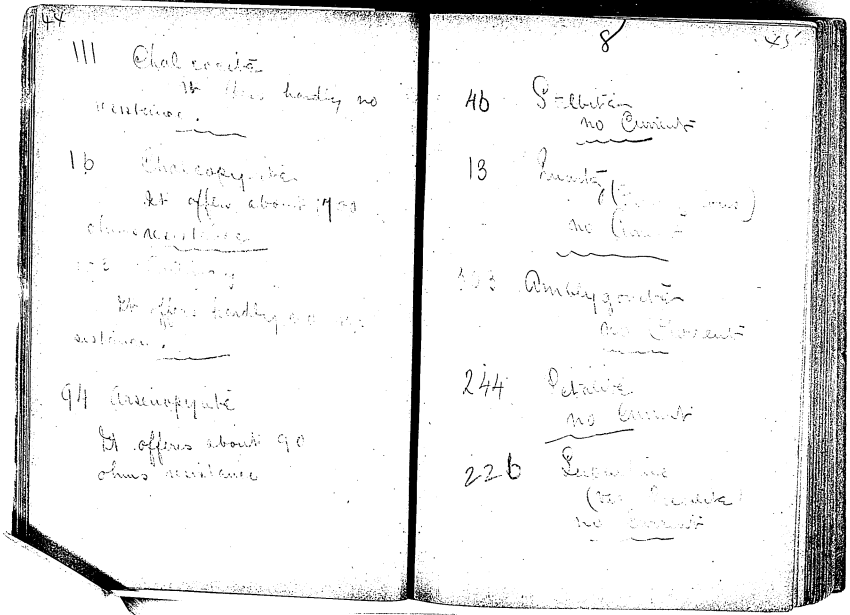
161 [illegible]
[illegible]

316 [illegible]
[illegible]

187 Marneux
[illegible]
du Cimetière

156 [illegible]
[illegible]

252 [illegible]
[illegible]



111 Chalcocite
It has heating no resistance.

1b Chalcopyrite
It offers about 17 ohms resistance

94 Arsenopyrite
It offers about 90 ohms resistance

8

46 Sphalerite
no Current

13 Pyrite
no Current

233 Arsenopyrite
no Current

244 Petzite
no Current

226 Galena
no Current

29 Beryl
No Comment

No Comment

No Comment

No Comment

No Comment

No Comment

48 Alexite
No Comment

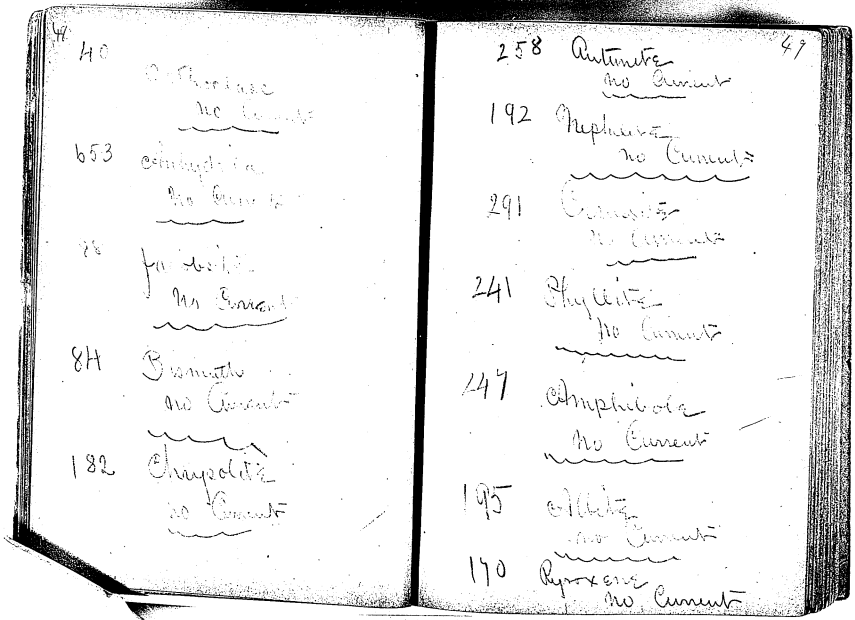
166 Apatite
No Comment

464 Chrome Diopside
No Comment

202 Corundum
No Comment

282 Cuprite (Cu2O)
See Structure

209 Cyanite
No Comment



by Pyrite

[illegible] a resistance
of about one & one half
ohms."

Capacity

It gives [illegible] and
resistance.

Magnetic Test

It gives [illegible]

[illegible]

By [illegible]

232

235 Dauvit

No Current

Syphilis

No Current

Various records

No 1 Barely any resistance

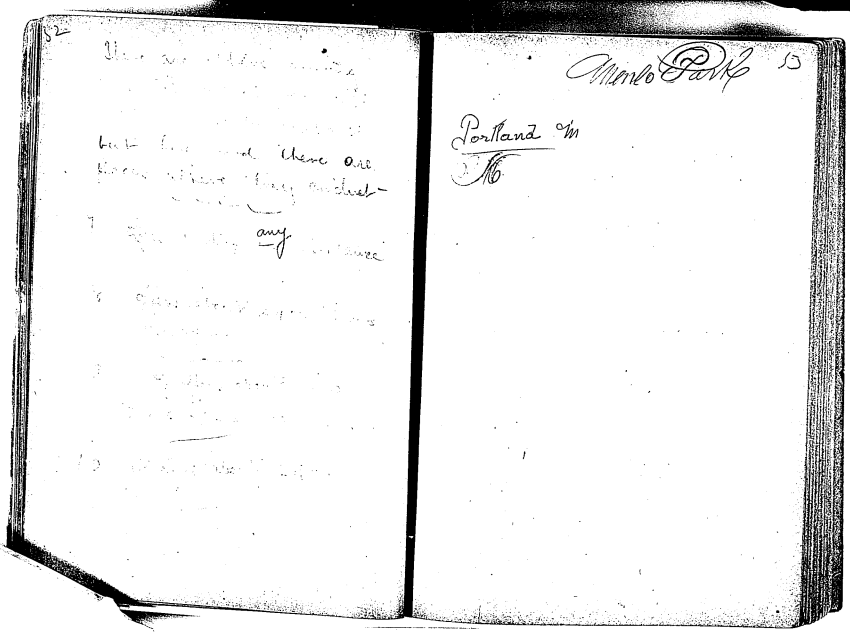
No 2 It offers about 47 ohms resistance

No 3 It offers about [illegible] ohms resistance

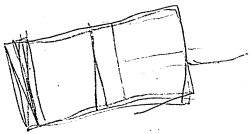
No 4 It offers about 7,000 ohms resistance

No 5 About 300 ohms resistance

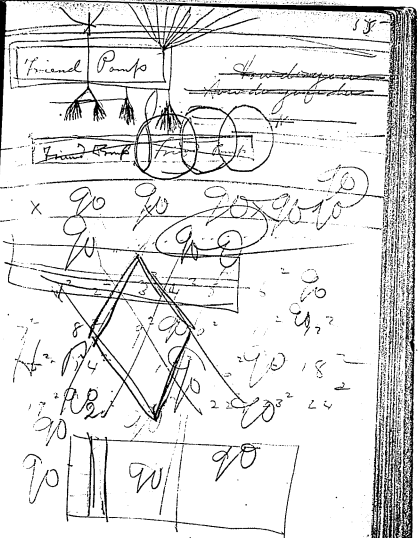
No 6 It offers about 9,000 ohms resistance



Hour-glass



Friend Pump



Test with Electric Engine & governor for opening circuit to regulate the Coil energy passing in a circuit.

Slow Speed

4 cells	deflection	3
5	"	4
6	"	4 1/4
7	"	4 1/2
8	4	4 1/2
9	"	5

Raised governor arm 1/8 inch

3 cells.	deflection.	7
4 "	"	4
5 "	"	7
6 "	"	5
7 "	"	6 1/2

8 deflection 3-½ 58
9 "

still further up.

3	Cells	– def	6 @ 7
4	"		6 @ 7
5	"		6 @ 7
6	"		6 @ 7
7	"		6 @ 7
8	"		6 @ 7
9	"		5-[illegible]

¼ inch higher up -

3	Cells	– def	22
4	"		0
5	"		10
6	"	"	10 ½
7	"	"	

60

~~Up fi~~

Up higher still oiled it = 61

3 cashs	def	21
4 "	"	8 1/2
5 "	"	5
6 "	"	7@8
7 "	"	6@7
8 "	"	5@6
9 "	"	6@7

Very high up —

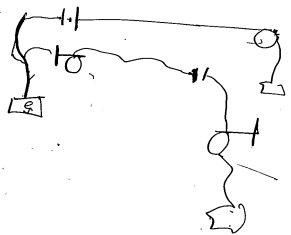
3 - cashs -	deflection	9
4 "	"	9
5 "	"	8 1/2
6 "	"	6@7
7 "	"	7
8 "	"	7
9		6@7

Put on stiffer spring on governor

3	Cells.		19 @ 20
4	"		.14
5	"		17
6	"		16
7	"	———	15 @ 16
8	"	———	14 @ 15
9	"	———	13

Put stronger spring on long fence

3	Cells -	dont work governor	—
4	"	difficult	18@19
5	"	"	14
6	"	"	12
7	"	"	13@14
8	"	"	16@17
9	"	"	16@17



Put governor up as high as it would go - don't open lever.

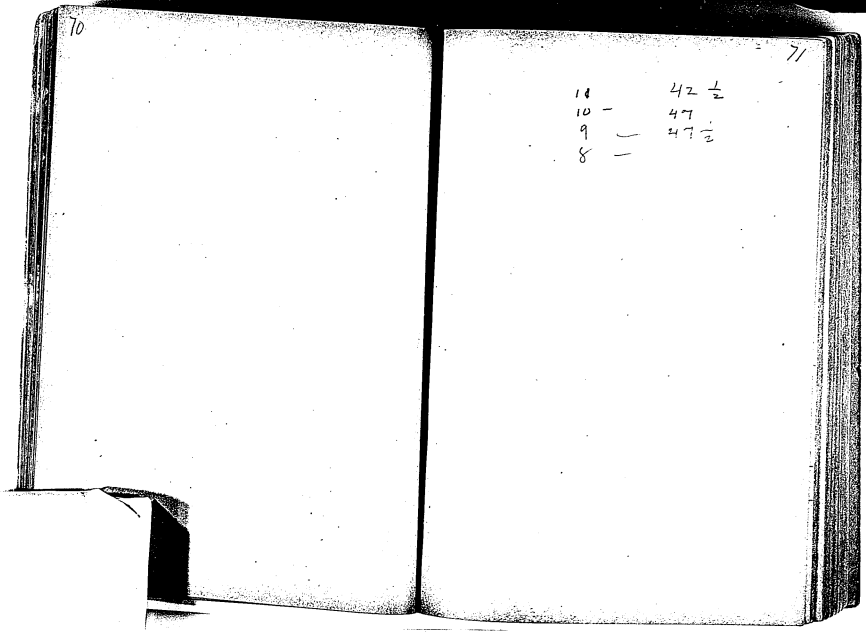
3	Cells	25
4	wires burn slightly -	25 ½
5	Cells work your ole —	29
6	" "	19.
7	" "	15
8	" "	15
9	" "	16

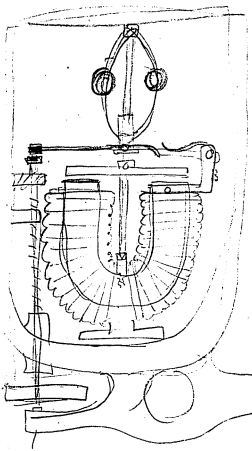
Shunted Engine Magnets with, 2 ohms

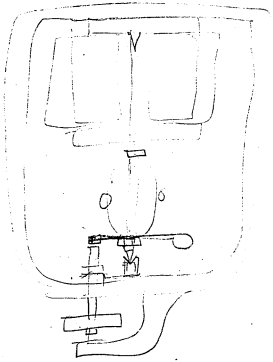
3	——	29
4	——	31 1/2
5	"	36 1/2
6	"	39 1/2
7	"	40.
8	"	40
9	"	39-
11 Cells —	——	36

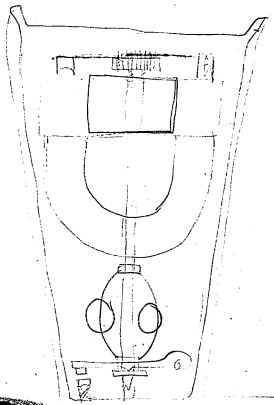
Shunted with 1 ohm –

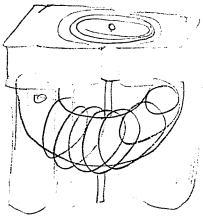
		deg
3	cells –	31
4	" –	36
5	" –	40
6	" –	42
7	" –	45 –
8	" –	46 ½
9	" –	– ? –
10	–	49 ½
11	–	50 – ½


70
71
11 42 1/2
10 — 47
9 — 47 1/2
8 —









96.1
139
1.9

940
57
28

76.9
231

757
243

73.5
765

66.7
33.3

71.4
286

62.5
375

[illegible]

Without limiting Score 781
219

56 1/2 with limiting

Score - 29 1/2

849
151
75

83.4
466

79.3
207

926
74
37

87.7
123
617

90.9
91
45

895
105
52

82
18
9

806
194
97

86.2
138
69

Limiting Screw Tension Spring Governor

3	ozs lbs	29 2
4	"	27
5	"	33
6	"	33
7	"	34
8	"	34
9	"	34
10	"	34
11	"	33.

984 / 16

97.1 / 29

take the Gracic step of Centre
at ~~9~~ 9 it goes incredible
goes to 15-

(Smith) Marq. ☆
.5 alum.

Qnt goes to 60 11 Cells.

11 Cells.	60 ½
9	0 @ 61
8	60
7	58.
6	NG

Mag Eng Shunt 1½ ohm 85-

11 cells — 50

10 45

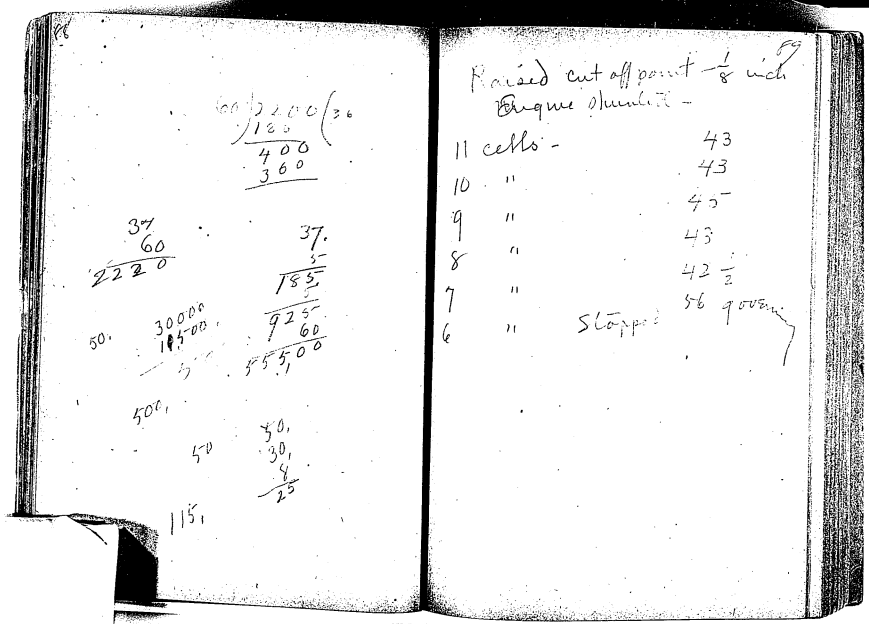
946	93	917
54	47	83
27	3.5	41

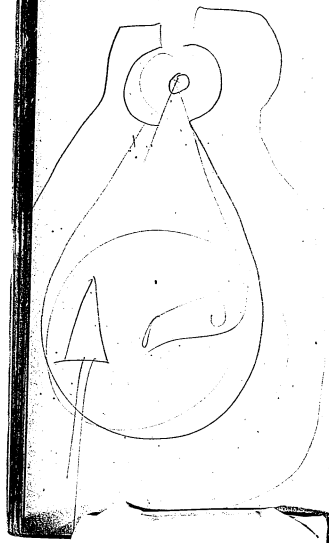
916
44
22

745
255
127

Fixed Eng.

11	cells -	49
10	"	50 ±
9		51
8		51
7	"	50 ±
6	"	47
5	"	40 ±
4	"	48
3	"	50 Stop[ped] [illegible]





Your Cuts off sleeves [illegible]

11 Cuts — 40 [illegible]

10 " [illegible]

9 " 40 [illegible]

" 45

7 " 45

6 " 40

5 " 40 [illegible]

4 " [illegible]

Balls [illegible]

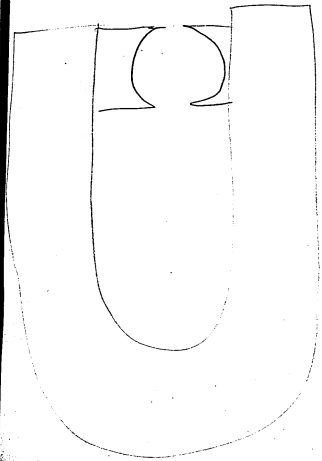
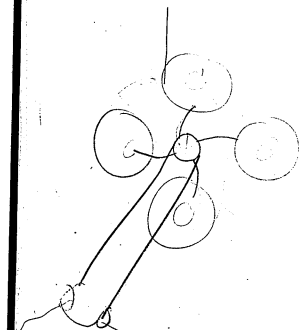
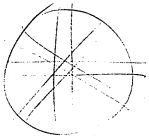
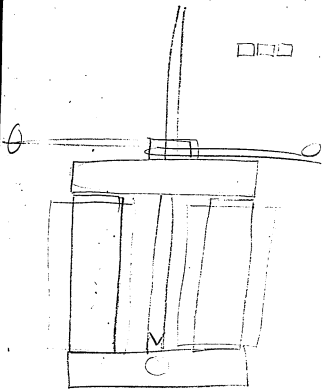


fig 19 a



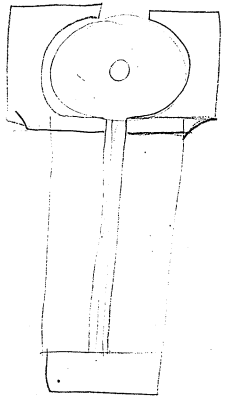


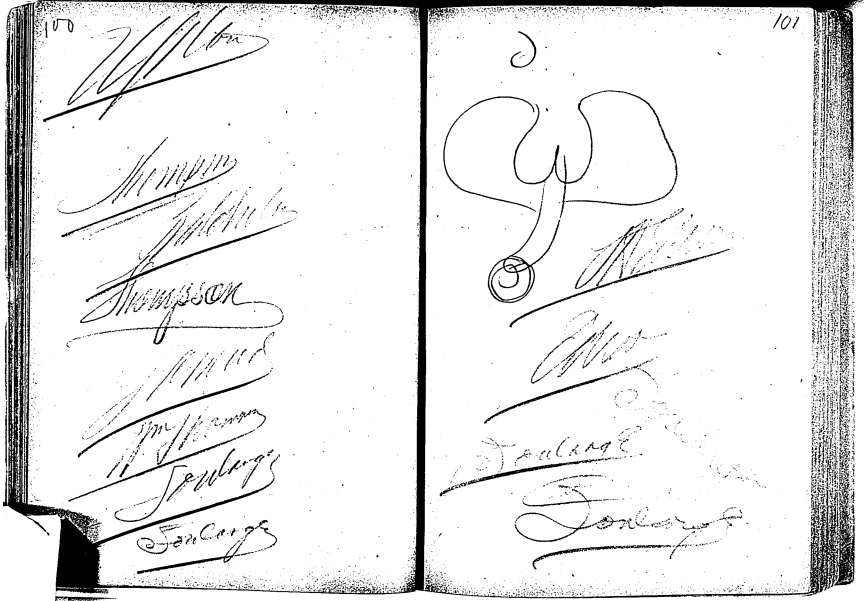


Upton

Portland

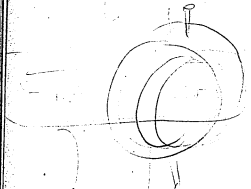
Batcheller





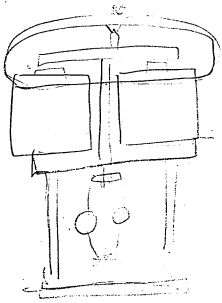
5000

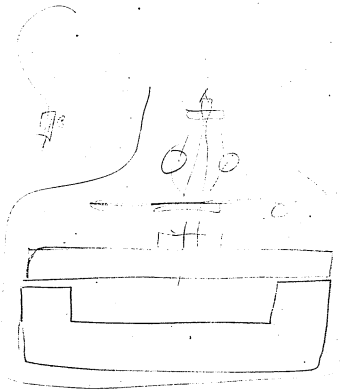
60000
10
600,000



12) 60,000 (5000
60
0

60 000
30
1,800,000





106

$$\vartheta_o = \frac{\mathcal{E} + \mathcal{E}_1}{R + R_1 + r'}$$

$$\vartheta_d = \frac{\mathcal{E} - \mathcal{E}_1}{R + R_1 + r'}$$

$$\vartheta_o + \vartheta_d = \frac{2\mathcal{E}}{R + R_1 + r'}$$

$$\vartheta_o - \vartheta_d = \frac{2\mathcal{E}_1}{R + R_1 + r'}$$

$$\frac{2\mathcal{E}_1}{\vartheta_o - \vartheta_d} = \frac{2\mathcal{E}}{\vartheta_o + \vartheta_d}$$

$$\mathcal{E}_1 = \frac{\vartheta_o - \vartheta_d}{\vartheta_o + \vartheta_d}\mathcal{E}$$

107

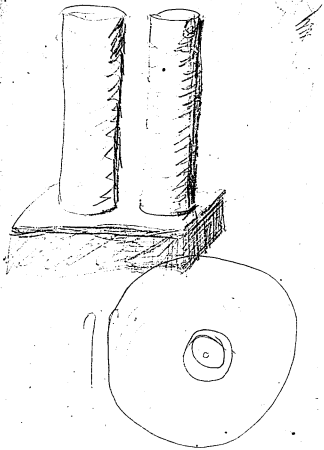
$$\vartheta_1 = \frac{\mathcal{E}}{R + r_1} \qquad \vartheta_2 = \frac{\mathcal{E}}{R + r_2}$$

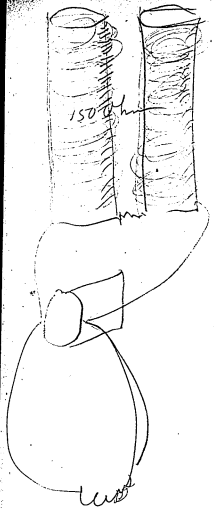
$$R = \frac{\mathcal{E}}{\vartheta_1} - r_1$$

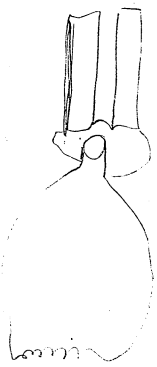
$$\vartheta_2 = \frac{\mathcal{E}}{\frac{\mathcal{E}}{\vartheta_1} - r_1 + r_2}$$

$$\vartheta_2 \frac{\mathcal{E}}{\vartheta_1} + \vartheta_2 \vartheta_1 (r_2 - r_1) = \mathcal{E}\vartheta_2$$

$$\mathcal{E} = \frac{\vartheta_2 \vartheta_1 (r_2 - r_1)}{\vartheta_1 - \vartheta_2}$$




150



6 1/8 6.125 inches diameter

100 Volts Current

10 Webers

Total resistance = 10 Ohms

felt but 3 feet each

72 inches

No. 10 wire

.134 = D

72 .8572

.132 7.205

545 turns

6.125	0.7871
3.141	.4930
comp 12	8.9208 - 10
45.	2.7364 0.2009
	12.9373
	2.9373

866 feet wire each layer

$\frac{2}{1732}$ on magnets Recover 4/

1737 feet to Ohm

545 turns on one magnet

10 workers

5450 = Strength

100 = Cost

1090 turns on whole

$\frac{10}{10900}$ = strength

100

1000 Ohms

10 100

100

10 cent

$\frac{100 \text{ volts}}{100 \text{ Ohms}}$ = 1 Watt

100 = Cost

No. 16 wire Current = $\frac{1}{10}$ before

.065 in = Diameter

covering .010

Total D = .075 in.

6 feet	72	1.8573
	.075	3.8751
		2.7822

960 turns

1.59 feet in turn

Log = .2009

408.7 feet per Ohm

100 Ohms

40870 . feet

.4.6107
1.2009
4.4098

25700 turns

545 turns before

25700 .4.4098
545 2.7364
1.6634

~~46~~ 23 times the turns
1/10 the current

~~46~~ 2.3 more effective
in

25700 .4.4098
960 2.9571
$\overline{1.4527}$

layers

28.5 1.4527
thickness .075 2.8751
~~5.5778~~
.3278

2.1 inches

12.78 for 1000 feet

40.870 1.6107
12.78 1.1060
2.7167

.521 lbs on
$1.25

Winding only one
magnet

10 Meters over flume

100 unit of E

44.5

4415.0 foot lbs. per minute

33000 4.5185
4450 3.6454
.8701

7.42 per H.P.

H.P cost 1.5 ct per hour

1.5 .1761
7.42 .8701
7.3060

2.03 mills.

2.03 cts. per day 10 hrs

365 days
2.00
1095
730
$7.695 per year

1/2 saved 3.70 per year
2 times per day
5 makes the magnet $37 could afford

In. 10 wire

1700 3200
Ft. 15.44 1.2650
1.9648

92.2 lbs Cu
40 cts per lb
$36.88

Mixed
Record

8 | 22400
2800

1/28

Magnet

Reference

Ans

60

42 000

42 224 | 33
32
92

1200

180
8 | 1500
37

2800
8
22400

80
240

120

200 tons a day

10 men

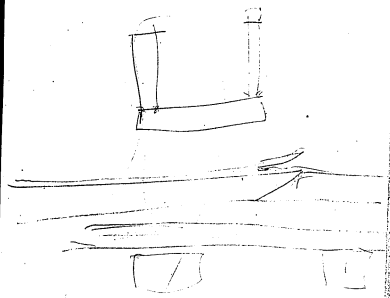
2

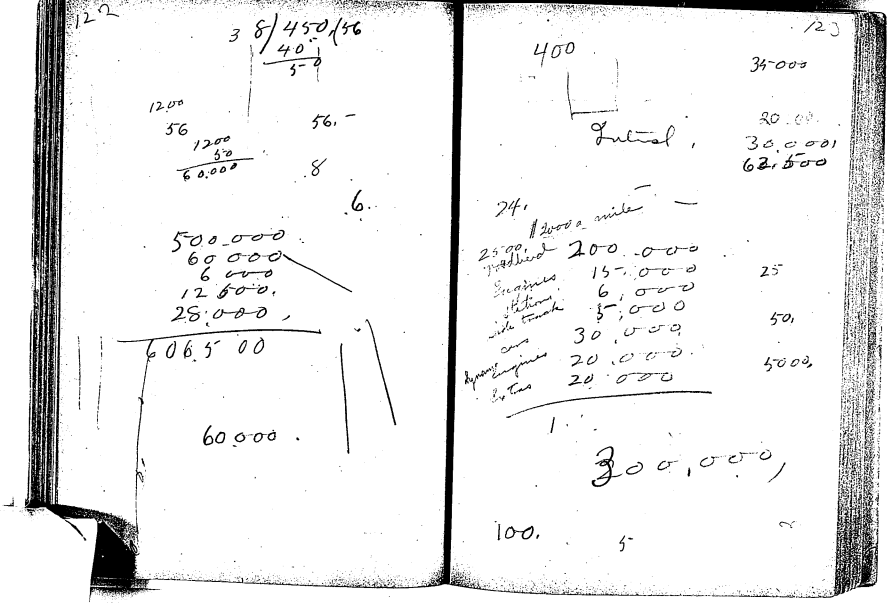
1 20

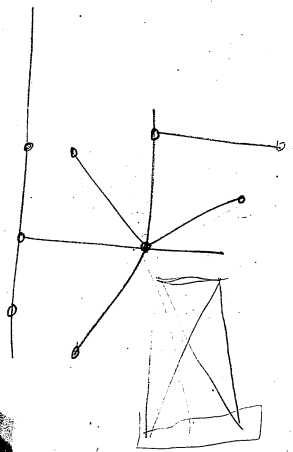
50 / 200

4

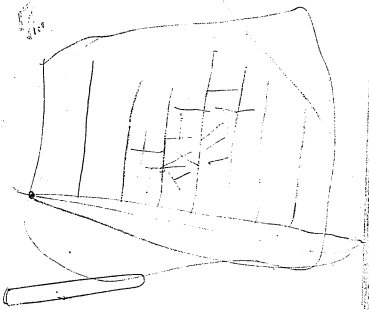
121







30



80.

160,

30

Magnet to have 1 H.P
given it If magnet is used
all day 24 hours

Cost 1 H.P. say 2 cents
the ~~receipts~~ total for one hour

Used for 24 hours
it would be ~~for~~ say 1.5 cent.

1.5	0.1761
24.	1.3802
365.	2.5623
	4.1186

$131.00 a year for H.P.
unit 8 hours a day at 1.5 cents
per hour.

3631
43.66

$ 1746	at 2 cents
$ 131.	at 1.5 "
$ 87.33	at 1 cent

In a magnet using 1 H.P
to run ~~$~~ 1/2 that is so
that a machine could
run 1/2 the power and be
equally efficacious, there can
be ~~saved~~ saving to this to bring 10% interest.

$ 873.3.	at 2 cents
$ 655.5.	" 1.5 "
$ 436.6.	" 1 cent

Rule to run a H.P

$ 1746	can be spent
1316	
873	

used all the 24 hours

1746
1316
873

Maid 12 hours there can be about

573.3
65.5.
436.

1746 3.24 88
24 1.38 12

816
65 28 1316 3 11 93
24 1.38 12

1.9.16

1.78 71

Maid 10 hours
816.
615
408

61.5
40.8.

615
8
4920

Maid 8 hours
852.
492.
326.

Maid 4 hours.
326
246
163

Maid 1 hour
81.6
61.5
40.8

3 feet long 0.125 in. ϕ

2 6 feet long

No. 8 wire .165
14
.179 in. Diam

6.1125 0.7871
3.141 0.4935
Sum's 12. 8.9208
.2014

1.59 ft. in one turn

6 feet = 72 in 72. 1.8573
Sum's .179 10.7471 −10
2.6744
403 turns 1.59 .2014
2.8058

639 feet of No. 8 wire in one layer

12.14 feet per ft

639 : 2.8058
12.14 1.0845
1.7213

52.6 lbs

= .2633 feet per Ohm

2.8058
2633 3.4205
7.2852
.242 Ohms

2 layers 806 turns
1278 feet
105 lbs
.492 Ohms

No. 9. Wire

.148 = .0
14
.162

15.1 feet in 1 lb
2119 feet in 1 Ohm

72 1.8573
cross .162 1.2095
2.6478
444 turns .2014
2.8492
707 feet 15.1 1.1770
468 lbs 1.6702
2.8492
2119 3.3261
1.5231
.333 Ohm
1332 turns to 1 Ohm

.007126 2.1475
140

No. 10 Wire

.134
.014
.148

72. 1.8573
.145 ÷ .1703
2.6870
.2014
2.8884
1.2651
1.6233

486 turns
773 feet
18.41

42. lbs

2.8884
3.2399
1.6485

.1737.

.445 ohms

2.6870
1.6485
3.0385

1090 turns to an Ohm

10106

94 lbs per Ohm @1.9747

136 Mr. H Hines

.120
13
.133

72
.133
Turns 541

860 feet
22.95
37.5 lbs

1.85-73
7 12 34
2.73334
20 14
2.9348
1.3608
1.5740

2.9348
1392.
.618 Ohms
3.1437
1.7910

2.7334
1.7910
2.9424
876 Turns to an Ohm

see Book 31 p. 91

.0164
1.7852
61.

No. 5 Wire

4681.1 feet per Ohm

.00145-9 — 3.1641 — 2.8359

685 lbs per Ohm

No. 6 3985. feet per Ohm

.002012 — 3.3036 — 2.6964

497 lbs.

No. 7 3134.8 feet per Ohm

.00 3254 — 3.5125 — 2.4875

307 lbs to Ohm

No. 5 Wire

220 / .14 / 284

72 · .1234

307 turns

491 feet

6125 : 63

334 / 259 — 3.8034

6125 — 3.7871

100 — 2.0163

Glasgow to an Ohm about

5-11

5-30

5-50

5-71

592

614

3859

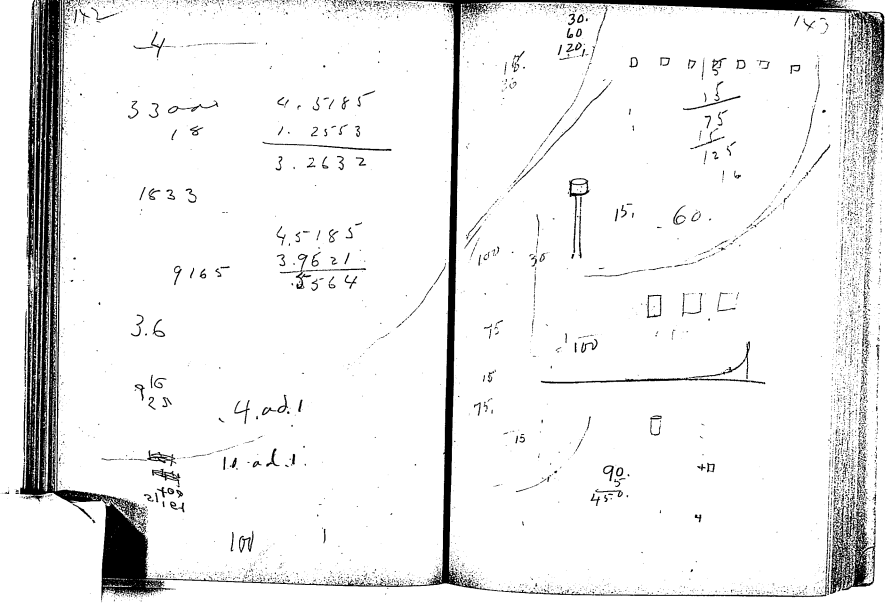
637

4496

1.85773
7.36792
2.48881
2.69274
.0163

307
5
2454

2.7888
.0163
2.7725
.0163
2.77087
.0163
2.78750
.0163
2.80413



Magnet

1 ohm

No. 10 wire

100 1.5

816 | 204 | 612

816

500 7.5 | 204 | 408

.48
365
1752
1752.
919
730.2
1919
2297
6893
4 | 1355.2
1836
5514

7.6812
2.562 3
2.243 5

7.68224
2.56327
2.24353
1.8833
1752
485
1347
878
478
399
557

2 cents on hmm

24

.48 cents a day

365 days.

$175.2

$43.79

$1752

$438

1314

438

876

876

219

657

219

438

1.6812

2.5623

2.2435

log 40 .6021

1.6414

log 4 .0602

1.0393

70

19

2.2435

.3802

1.8633

24

1919

229.7

5893

2293

1600

1.8633

1.9633

Ans!

365

2

730

730

36.5

18.25

5475

2.2435

.3802

1.8633

1 540

15 total 540

36 apiece

they will equivalent to

1080 candles

15 of

7½ of 15 37.0

7½ of 36 135 candles

36

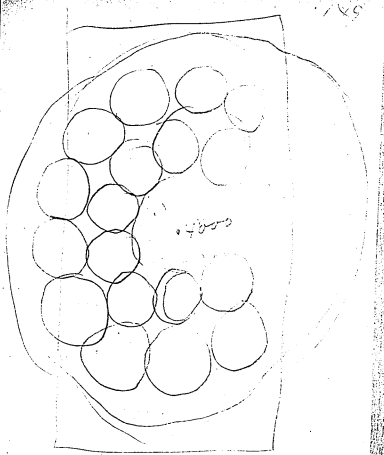
$15^2 : 6^2 :: $:

36 1,55·63

36 1,55·63

1761 3·11·26

35 22 2·35·22



15 : 4000 :: 3^2 : x^2

4

36000

15

4.5563

1.1761

3.3802

1.6901

49 feet

15

7 feet long

7 | 100

14

3

45

45 Gasburners

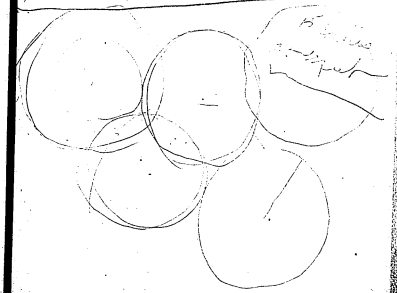
15

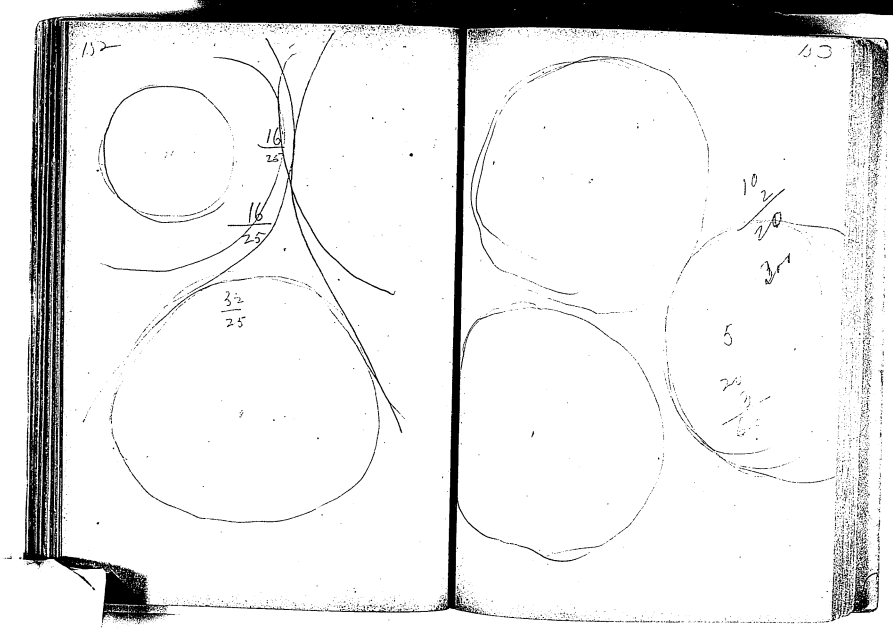
225

45

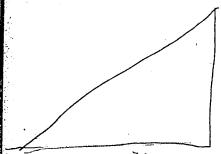
675

675 Candles as good as a 4000 Candle power if the ~~light is~~ [illegible] ~~stronger~~ light is needed than a gas burner at [illegible] feet




112
16/25
16/25
32/25
10
2
20
5

15 Candles in circle of 75 feet radius and 30 feet above the floor



1.8751
1.8751
3.7502

900
562.5
6525

log 3.8145
1.9072

80.7 feet

6525 — 3.8145
16 — 1.2041
4075 — 2.6104
4000 — 3.6021
2.6104
.9917

9.82 Candles at four feet away

five feet circle

6525 — 3.8145
25 — 1.3979
2.6166
3.6021
2.4166
1.1855

15.3 Candles

150

$\frac{75}{6}$

69 7

5

80.7	1.9072
11.	1.041v
	.8668

80.7
7.359

72.35

3141	1.8591
	.4969
	2.3560
227	.8668
	1.4892

2 | 30.8
15.4 amps

11 [illegible]

15

$b_1 = 1360$

$a_1 = 1010$

$b_2 = 2960$

$a_2 = 950$

158

7.36
2
14.72

72,35
14.72
57.63
14.72
3.14

1.7604
8.8327
.4969
1.0700

12.4

57.63
1472
42.91

1.6325
8.8327
4969
10.9721

9.36

9.1296

42,91
1472
2819
1472
47
14.72

1.4502
9,12..
.5798

1..1673
9,12..
2..6.

194

30.8
24.8
18.8
7.6
1.9
11
85.7
15
1280

1.9532
1.176
3.1291

Carlisle & Finch
the pioneer of Morse candle
power

In a space 150 across having a 4000 candle light 30 feet above the floor it would take

$5 [illegible]

Total 1280 candles

Total 1280 candles
1280
12

3 times more effective

4000 — 3.6021
1280 — 3.1072

3.12 — .4949

3.12 more effective

Room 100 long 23 ft.

4000 candle power

50

3 feet

2500

2500 : 7 : : 100 : 14

25 × 60000 (illegible)

25
110

1/

5.5.

100 4

12

162

Suppose 75 feet

30 feet above

that 80.7 see p. 157.

$9\overline{)80.7}$

8.94

80.7 × 8.94 = 721.76

5150

$\sqrt{.86556}$ = .93035

3.7116

$\sqrt{5150 : 8.94^2 :: 2000}$

.9513

.9513

1.9026

3.4771

5.3797

3.7116

2.6681

46.

5150 · 3.7116

163

5150 : 5^2 :: 4000 :

Eng 2 5

1.3979

1.3979

3.6812

4 rows

6.3979

3.7116

1.4

1.3979

3.6812

5.3791

3.7116

1.6675

(6) 75^2

1.875

1.875

3.5156

1.3979

5.5135

3.7116

1.4019

26.7

60

$75^2 : 5^2 :: 4000 :$

1.1875-1	6.2498 − 10
1.8751	1.3979
3.7502	3.6021
	1.2398

17. Candles

$75^2 ; 4.5^2 :: 4000$

6.2498
3.6021
.6532
.6532
1.1583

9.8319 − 10

14.4 Candles

4.7

9.8519 − 10
.6721
.6721
1.1961

15.7 Candles.

[illegible] at a [illegible] distance 4.6 feet will give as much illumination as a 4000 candle power light at distance of

---

$75^2 ; X^2 :: 4000 :$

~~6.2498~~
3.7502
6.3978
1.1761

9.8519 − 10
1.1761
1.6758
1.8140

X = 241 − 10
1.6620

1.6 feet

166

Arrow

$\frac{25}{46^2} + \frac{25}{46^2}$

.16628
.16628
1.33256

$4.6^2 = 21$

$\frac{1}{21}$ = intensity light 4.6

$\frac{1}{25} + \frac{1}{25} = \frac{2}{25}$

$\frac{1}{36} + \frac{1}{36} = \frac{1}{18}$ intensity at 6 feet

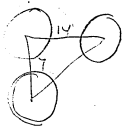
$\frac{1}{49} + \frac{1}{49} + \frac{11}{245} =$

$\frac{1}{49} + \frac{1}{49} + \frac{1}{61}$?

$= \frac{3}{49}$ of other light
Taken into consideration

$= \frac{1}{18}$

167



14
14
56
14
196
49
245

2.3892
1.546

15.6

7.2 feet will be the radius of the light

14.4 = Diameter

14.4)75 (5
14.4
.21

.5751
1.1584
.7167

14.4
5
720
3

168

7.2

75
7.2
678
2
135.6

3.14

comp. 14.4

~~329~~
30.4

2.1320
~~.5514~~
.4969
~~8.8539~~
~~1.8173~~
1.4828

169

$75^2 / x^2 :: 3000 : 15$

1.8751
1.8751
3.7502
1.1761
~~4.~~9263
3.4771
1.4492
.7246

$\frac{1}{28}$ = intensity

$\frac{1}{49} + \frac{1}{49}$ =

$\frac{1}{64} + \frac{1}{64} + \frac{1}{32}$

that $\frac{3}{81} = \frac{1}{27}$

9 feet Radius

75 / 9 / 66 / 132

18 / 2 / 36

3.14 Group 18

2.1206 / .4969 / 8.7447 / 1.3622

9.2416 − 10

23

132 / 36 / 96

16.7

9.2416 / 1.9823 / 1.2239

96 / 36 / 60

10.4

9.2416 / 1.7782 / 1.6198

60 / 36 / 24

9.2416 / 1.3802 / .6218

1 / 4.18 / 10.4 / 16.7 / 23 / 53.28 Comp.

15

1.7424 / 1.1761 / 2.9185

829 Candles

3 sec

829

3.1771 / 2.9185

3.62 .5586

3.62 more effective

2000 candles

The space to be illuminated is taken as 72 feet distant from the light. The light the same as before 30 feet above and having a circle of 60 feet radius to illuminate.

$12^2 : x^2 :: 2000 : 15^-$

1.8573
1.8573
1.1761
Cy 15 — 1.1761
2000 — 6.6990 — 10

2 | 1.5897
98.9 — .7948

= 6.23 feet

38.9 — 1.5897
3 — .477
116.7 — 2 | 2.0668
10.8 feet — .0334

15
10.8
64.2 — 1.8075
2 — .3010
9.14 — .4770
Comp 21.6 — 1.6635
18.6 — 1.2710 — .4635

64.2 — .8075
21.6 — .3345
42.6 — .4730
12.4

144

42.6
21.6
210

6.11

9.4635
1.3222
.7857

2.
6.1
12.4
18.6
39.1
15

1.5922
1.1761
2.7583

573

2000
573

3.3010
2.7583
.5427

3.49 times more effective
than in gas burner

1000 candle power

The strength at 65 feet distant
from the light

$65^2 : x^2 :: 1000 : 15$

1.8129
1.8129
1.1761
1.7019
.8509

50.3
7.1

50.3
3
50.9

2.1727
1.5563

12.2 feet

75.
12.2
628

1.7482
3.3010
.4472

3.1
24.4
16.1

8.6726
1.2386

9.4006

176

6.2.8
24.4
3.8.4

9.4006
1.3843
.9849

9.6

38.4
24.4
14.0

9.4006
1.1461
.5467

3.52
9.6
16.1
29.2
15
438

1.4654
1.1761
2.6415

1000
438

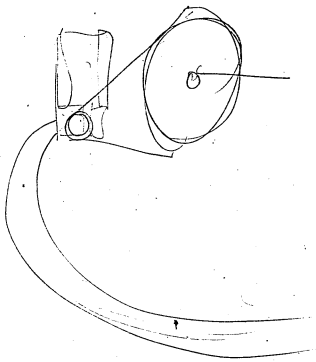
3
2.6415
.3585

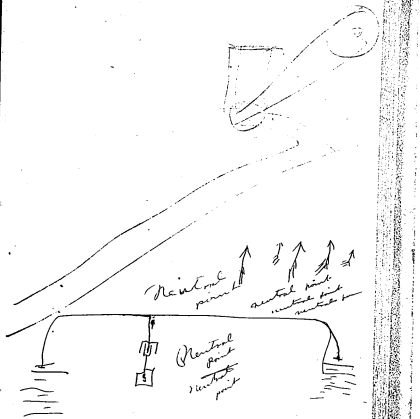
2.28 times better.

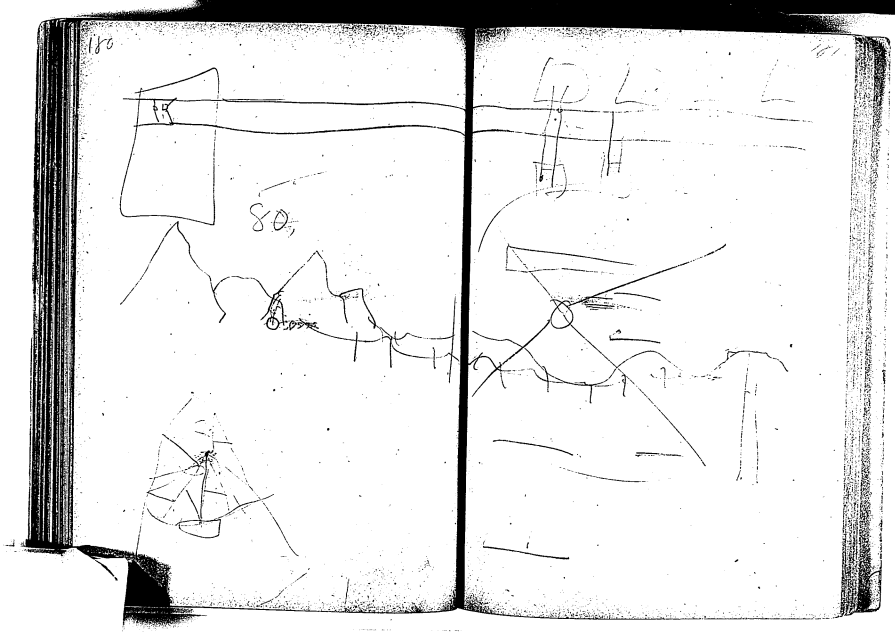
177

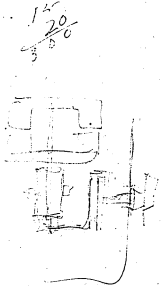
In this case very much of the area is better lighted since that part which is near the

Page 196

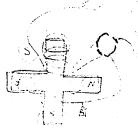



Neutral point
Neutral point without pick


180
SO,
Ocean



*

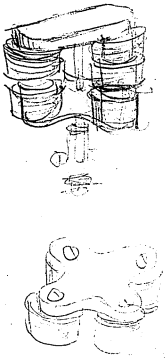


Gou

George E Gowdier Governor

Constitution

Rondout Constitution



100
1 1.5

Comp 101.5
log 100

98.4
96.8

Comp 51.5
log 50

971
94.3

3 33.3
1.5
34.83
33.33

956
25 914
1.5
26.5
25

946
895

8.9935
2
9730
1.9860

8.2882
1.6990
9872
9714

8.4581
1.5224
9805
9610

8.5728
1.4031
9759
9518

20
1.5
22.5
20

93
86.5

15.66
15
10.16
15.66

917
84.1

14.28
1.5
15.78
14.28

905
81.9

12.5
1.5
14.0
12.5

893
79.7

8.6678
1.3010
4776
4686
9372

8.7409
1.2218
9627
9258

8.8019
1.1547
9566
9132

8.8539
1.0969
9508
9116

9
11.11
1.5
1261
11111
8.8993
1.0457
1.9450
8900
881
77.6

10
10
1.5
11.5
10.00
8.9392
1.
9392
8784
869
75.6

11
9.09
1.5
10.59
9.09
8.9751
1.9585
9236
8672
858
73.1

12
8.333
1.5
9.833
8.333
9.0073
1.9206
9279
8558
847
71.7

13
7.692
1.5
9.192
9.692
0.366
1.8859
.9225
8950
836
70

14
7.14
1.5
8.64
7.14
9. 0634
8537
9171
8342
82.6
68.3

15
8.66
1.5
9.16
6.66
9.0884
8234
9118
8236
81.6
66.6

16
6.25
1.25
7.75
6.25
9.1107
.7958
1.955
8130
80.6
65

17 5.882 1.5 7.382

18 5.555 1.5 7.055 9.1515 7462 .8957 78.4 5 61.9 7914

20 1.15 6.15 51 9.1871 6989 .8860 76.9 59.2 7720

25 4 1.15 5.15 4 9.2695 6020 .8715 74.5 55.3 7430

30 3.33 1.5 4.83 8.37 69. 9.3161 .5225 .8889 47.6 6778

100 1.5 20 3 600

171 1965 5 9825 1923 5 9615

1881 5 9405 1849 5 9245

1814 5 9070 1714 5 8570

1653 5 8265

1591 × 5 = 7955

1486 × 5 = 7430

1389 × 5 = 6945

1280 × 5 = 6400

1150 × 5 = 5750

1922 × 5 = 9610

1849 × 5 = 9245

1714 × 5 = 8570

1653 × 5 = 8265

1486 × 5 = 7430

1389 × 5 = 6945

1135 × 5 = 5675

95.2 + 95.2 = 90.6

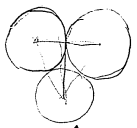
9786 + 9786 = 19572

1020 × 5 = 5100

888 × 5 = 4440

2.1576
2.1576
.4971
4.8123
.6020

196 Page 177.



500 candles

@ $6.0^2 : x^2 :: 500 : 15$

1.7782
1.7782
1.1761
Comp 500 7.3010 − 10
2 | 20335
108 1.0167
10.3 feet

324 | 2,51105
18.2 1.2352

35 feet

50 1.6990
31 0.4914
.3010
Comp 2.5 8.6031
1.0995

12.5 .3979
7.25

.28

7.25

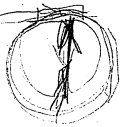
15 1.1761
2.0542

1.29

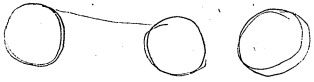
500 2.6990
199 2.0782
.6208

4.5 times water

191 72



Dynamo machine
Dynamo machine
Dynamo machine
Dynamo machine



199

80 220 135 = 1
42 : 0
57 : 1

12 75 feet wire

cost of wire?

1.6 = 1
7 = 1
T. 2 : 1

Gas 1 cent an hour
2 hours a day
T. 4 11
T. 4 : 1

2 cents
365
730 $ 3 73

$ 73 capital to pay for
a gas jet an hour
a day

365
2
730

1752

1752 3.2430
24 .3842
2.8628

729

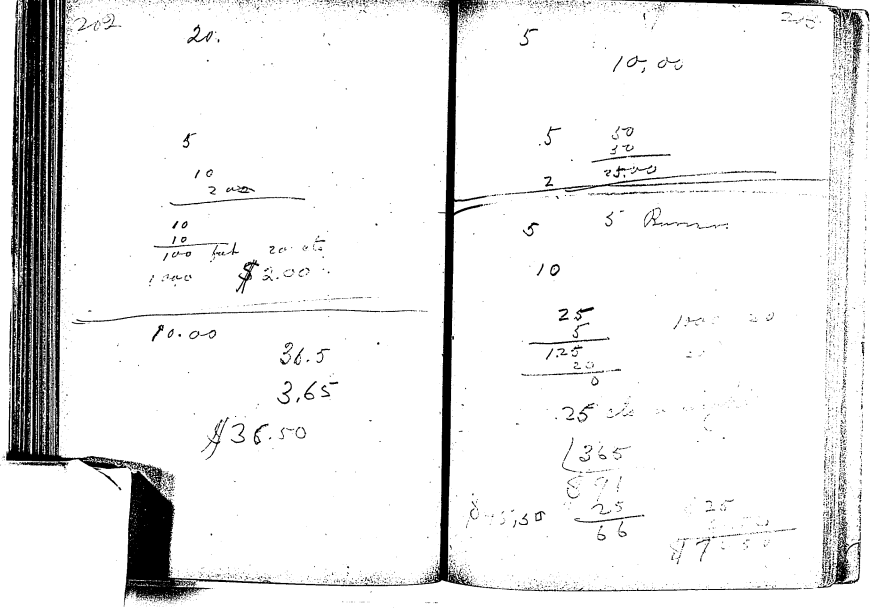
365
2
730

¥73.00

5

1

36.50

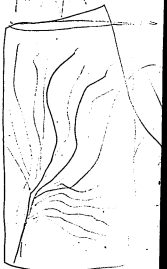


$450
$4.50
$45.00

5000
1
800

365

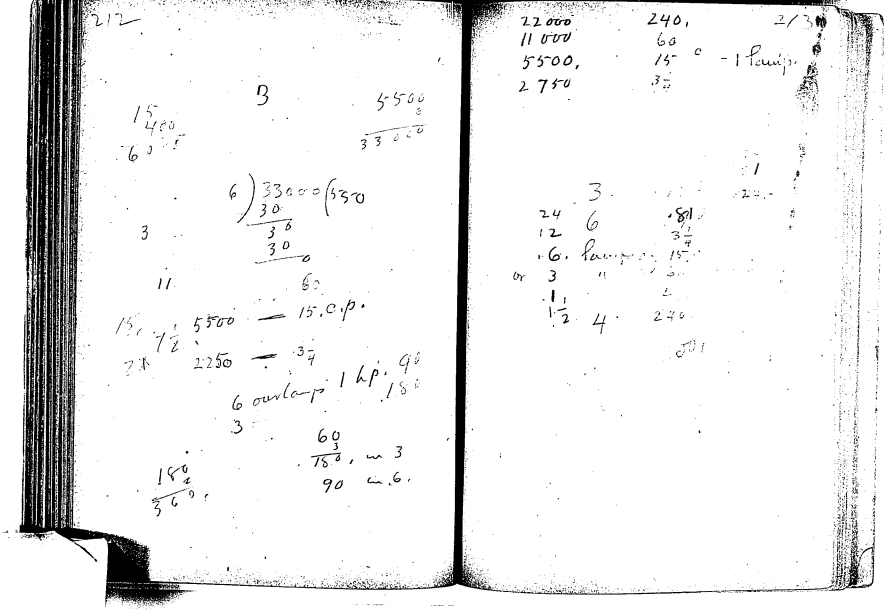
100 Ohms
.02 Ohm
5000



206

40

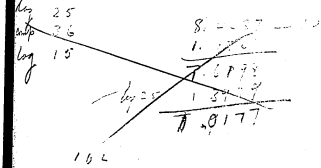
5 ℓ 80.



176.9
2041
1.9720
3802
.3522

225

9
9)115
375
9
32 75
4 4
128



log 86
log 15
25
21.6
108.

1.5563
1.1761
2.7324
1.3424
1.3900
1.1430
3.0330

7

49

110

77

2.7324

1.6902

1.0422

8

64

84.4

68.52

2.7324

1.8062

0.9262

9

81

6.66

59.94

2.7324

.9085

.8239

10

54

54

2.7324

.7324

11

121

4.46

446

49.06

2.7324

2.6828

.0496

12

1139

1139

3.2278

3.19

41.55

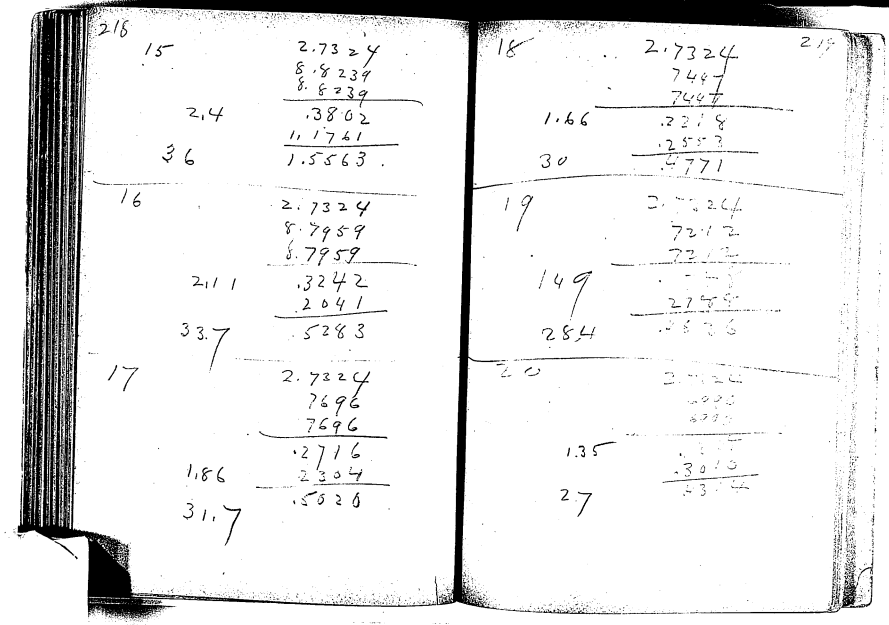
13

1461

2.75

38.5

14


218

15

2.7324
8.8239
8.8239

2.4 .3802

1.1741

36 1.5563

16

2.7324
8.7959
8.7959

2.11 .3242
.2041

33.7 .5283

17

2.7324
.7696
.7696

1.86 .2716
.2304

31.7 .5020

18

2.7324
.7447
.7447

1.66 .2318
.2553

30 .4771

19

2.7324
.7212
.7212

149 .2788

284 .5000

20

1.35 .2701
.2299

27 .4599

21

21

2.7324
.6778
6778
1.22 .0880
3222
25.7 .4102

22

2.7324
6576
6576
1.11 .0476
3424
24.6 .3906

23

2.7324
6383
6383
~~4295~~
10.2 .0090
3617
23.4 .3707

1 light 540 candles

15 lights

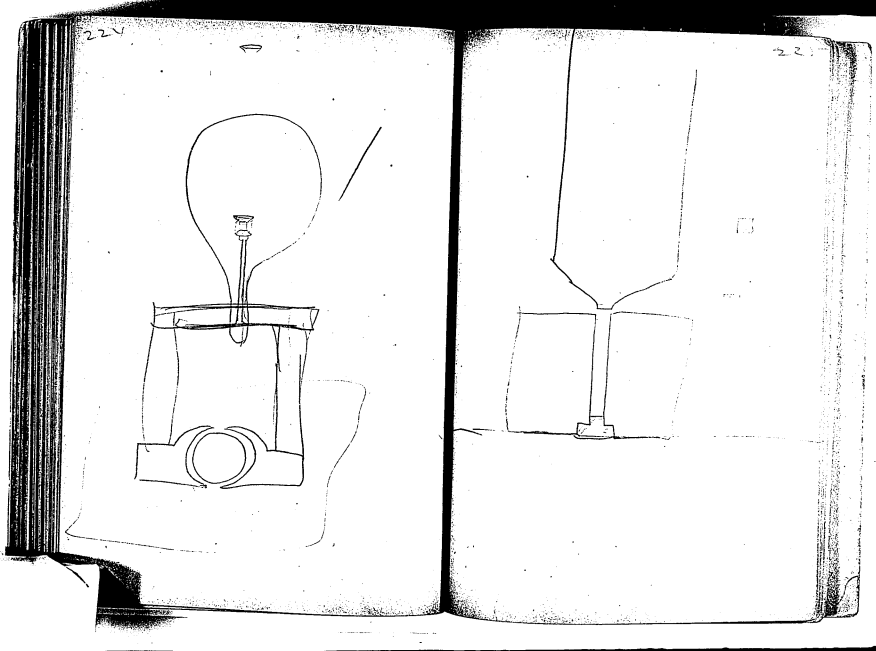
15 lights 36 candles each
= 540
but equivalent to 1080 candles

15 lights 18 candles
= 270 candles
equivalent to 540

15
15 225 lights 12 candles
225 each = 270

15 lights 12 candles 540

225 of 16 yards each 30 2



228

10%

200

10 | 2.3010
1.

1/10

110 | 110
100

2.3010
2.0414
.2596

18.1 years

22

1.10 | 1.0
1.10 | 1.10
1.10 | 1.10
1.10 | 1.10
1.10 | 1.10
1.10 | 2

log 2. .3010
.0414

.0414
.0414
.0414

7% 10 years

.0414) 3010 (7.2 years
2898
1120

294) 3010 (10.
294
0700

7% 10 years

0212) 3010 (14 years
212
890
848
420

0212) 3010 (
14 years
14 years
14 years

10 o'clock
5 o'clock
14 years to have double
14 years to have double
14 years to have double
14 year to have double
14 years to have double

How do you get that now
How do you get that now
How do you get that now
Magnet 7 years 7 years 7 years
7 years 7 years 7 years 7 years 7 years
7 years 7 years 7 years 7 years 7 years 7 years
7 years 7 years 7 years 7 years 7 years 7 years
7 years 7 years
14 years

253) 3010 (11.8 years
253
480
253
2270

1.06
1.06
636) 1000 (26
1.06
1,1236

11.8
378
11.8
496
11.8
614

26 5000
7
35 10000
7
42 20000
7
49 40000
7
56 80000
63 160.000

6 5000 2 5000
4000 2 5000
2000 10000
4000 20000
8000 40000

How long will it run.

$4000

$4000

$100.000

$100.000

$100.

234.

12 3 coat long

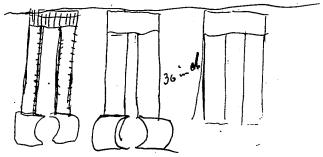
6 1/8 in. diameter

6.125 in

18 machines from one

3 are 6 ohms each

or 6 ares 12 ohms



Both magnets

72 in long

6.125 0.7871

3.141 .4970

1.2841

12 1.0792

2049

1.6 feet

1.6 feet

½ ohm ½ ohm ½ ohm ½ ohm ½ ohm ½ ohm

½ ohm ½ ohm ½ ohm ½ ohm ½ ohm ½ ohm

½ ohm ½ ohm ½ ohm ½ ohm ½ ohm ½ ohm

½ ohm ½ ohm ½ ohm ½ ohm

No 10 wire

.134 in D

14 coats

.148 in

lay 72 1.8573

coat .148 10.8297 -10

2.6870

497.8 turns in 2 layers

995.6 2.9978

1.6 .2049

3.2027

159.3 feet

1595 feet on magnet
1737 feet per Ohm

1595 — 3.2027
1737 — 3.2398
1.9629

.918 Ohms

16.44 feet to lb.

1595 — 3.2027
16.44 — 1.2658
1.9369

86.4 lbs. — 1.6021
.40 cts to lb. — 1.5390

$34.50 cost
$32.50 5

½ H.P.
½ H.P.
½ H.P.
½ H.P.

Make the same no. of turns and have the resistance ½ Ohm
That is use two strands of No. 10 wire
Cost $69.00

If the machine is to head with low outside resistance this is the way to wind it

If the machine is used ten hours a day on 6 and the magnet consume in the first case
1 H.P. by this can be saved
½ H.P at 2 cents
73 — $365 can be effected
5
365

This supposes that the machines is used on a resistance of 4 Ohms uses 4 H.P on 6 H.P to an Ohm

100 Volts

100 Volts

6 1 Ohms

1 36 Ohms

---

6 Ohms

$6 = 6$

$1 \times 6 = 6$

$\frac{36}{6} \times 6 = \frac{1}{6}$

---

36 Ohms

240

No. 13 wire

.095 = N
.012
.107 = D

72. 1.8573
Comp .107 10.9706 -10
2.8279 -10
.2041
3.0320

673 times
1.6 feet
1074 feet

873 feet to Ohm

873 1.5563
2.9410
4.4973
3.0320
1.4653

29.2 Layers

25 Layer

673 times
16825 times

if 40 layers 500).2704
42
5.40

5.4 times stronger

679 5 Layers

5

36 Ohm 1.5563
873 feet to Ohm 2.9410
4.4973
3.0320
29.2 Layers 1.4653

.0419 1.3778
36 1.5563
2.9341
1859 lbs 1.1021
40 2.5362
$343

241

242

No. 20 wire

36 ohms

.1035
.041

72 1.8573
.041 11.3872
3.2445

1755 turns
1.6 feet
2820

.2049
3.4494

118.5 2.0738
36 1.5563
3.6301
3.4494
.1807
3.2445
3.4252

1581

2660 turns

No. 10 wire

995 turns

2660 3.4252
995 2.9978
.4274

267

3.4494
.1807

Do not throw away my wheel

1/6 current

36 1.5563
2.27 0.3560
1.2003

15.9 lbs

Extract 1/2 an atom

243

If magnet shunt 3 times E. M. F.

No. 19 wire

.42 / 5 / .47 — .047 — 33

72 1.8573
10.3279
~~1.5294~~
3.1852
~~1535~~
1535 turns
.2049
3.3901

1 Ohm

Gramme machine for example in a carbon light 1/2 Ohm in ring
1/2 Ohm in magnet
1 Ohm in lamp

E. M. F 75 Volts

E. M. F. 75 Volts

1 H. P. required

1/4 75.

18.75 Webers

18.75 — 1.2728
18.75 — 1.2728
4 — .6021
44.5 — 1.6484
4.7961

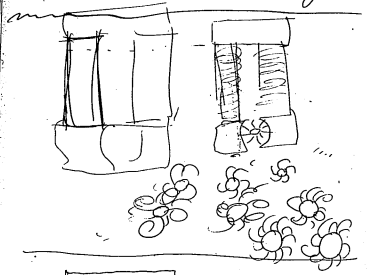
61,700 ~~ft~~ lb

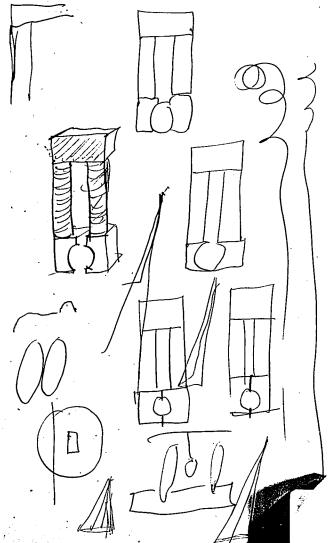
4.7961
33000 — 4.5181
.2780

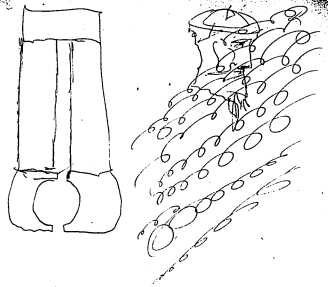
1.9 H. P.

246

1/2 H.P. on magnet







½ H.P. ○ ○ ○ ⊗

½ H.P. ½ H.P. ½ H.P.

½ H.P. ½ H.P.

To render the instrument less 4 watt proof

How machine wound ½ ohm in circuit what will be the resistance in shunt to consume the same amount of energy

E.M.F. = 4

Current = 1

R = 1 Work = 1

E.M.F. = $\frac{2}{3} \times 4 = \frac{8}{3}$

$\frac{64}{9} = R$

$\frac{9}{64} = c^2$

$c^2 R = 1$

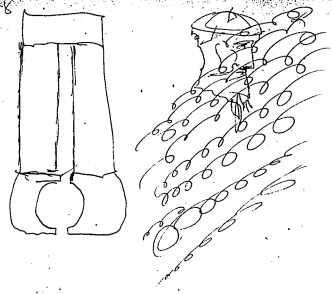
$\frac{64}{9} = 7.111$ ohms before

$\frac{8}{3} \times \frac{8}{8}$

$\frac{64}{9}$

$\frac{3}{8} = C$

$\frac{3}{8} = .711$



½ H.P. ○○ R

½ H.P. ½ H.P. ½ H.P.

½ H.P. ½ H.P.

1

To render the instrument less
[illegible] to [illegible]

Now machine wound ½ ohm
in circuit what will be
the resistance in shunt to assume
the same amount of energy

E.M.F = 4

Current = 1

R = 1 Work = 1

E.M.F. = $\frac{2}{3} \times 4 = \frac{8}{3}$

$\frac{64}{9} = R$

$\frac{8}{3} \times \frac{9}{64}$

64

$\frac{64}{9}$

$\frac{3}{8} = C$

$\frac{9}{64} = C^2$

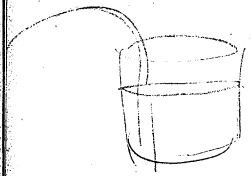
$\frac{3}{8}$ .711

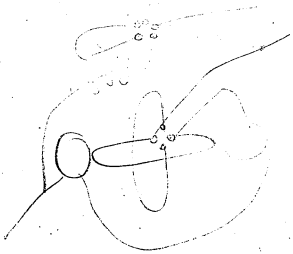
$C^2 R = 1$

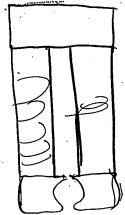
$\frac{64}{9} = 7.111$ ohms before

Siemens — 70-
Gramme — 5-5-
Wallace 13
Edison 88@90-

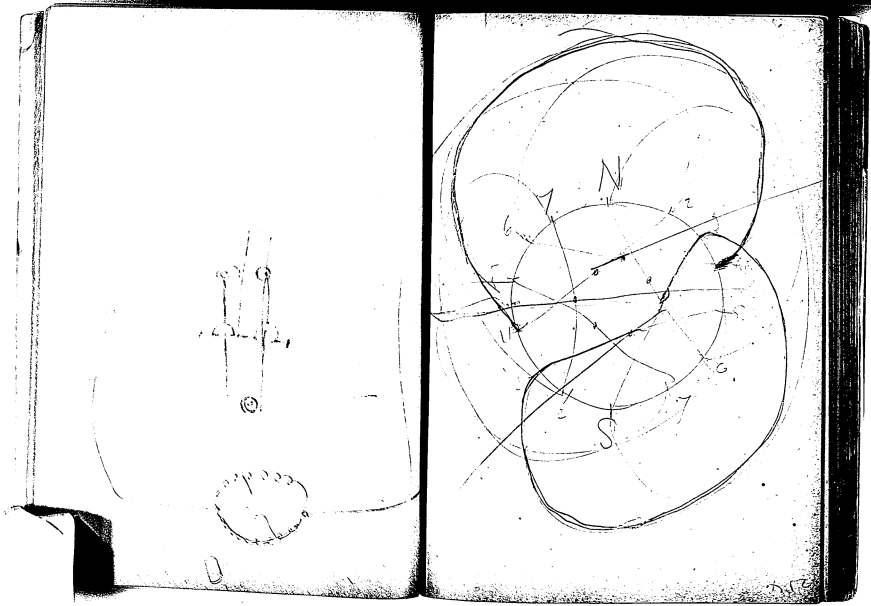
40.
55

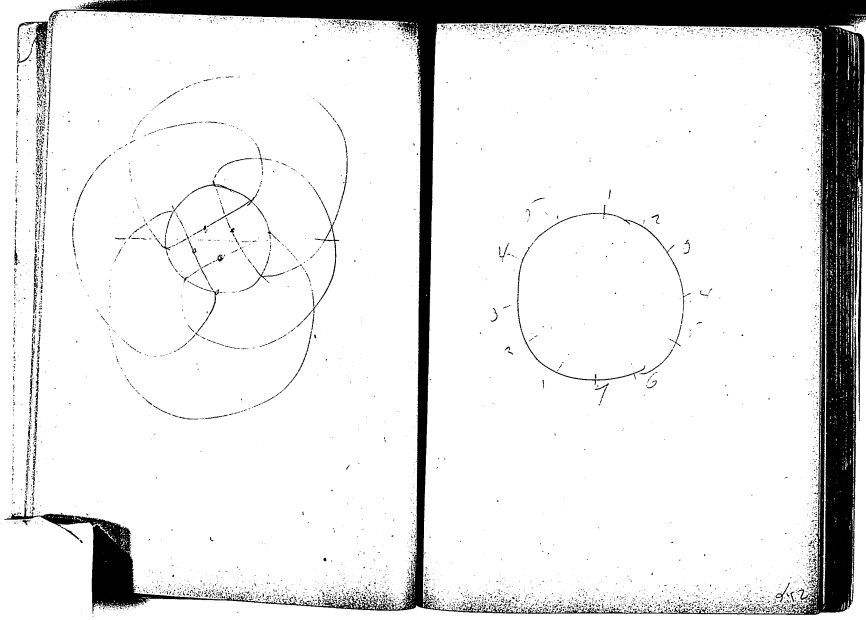


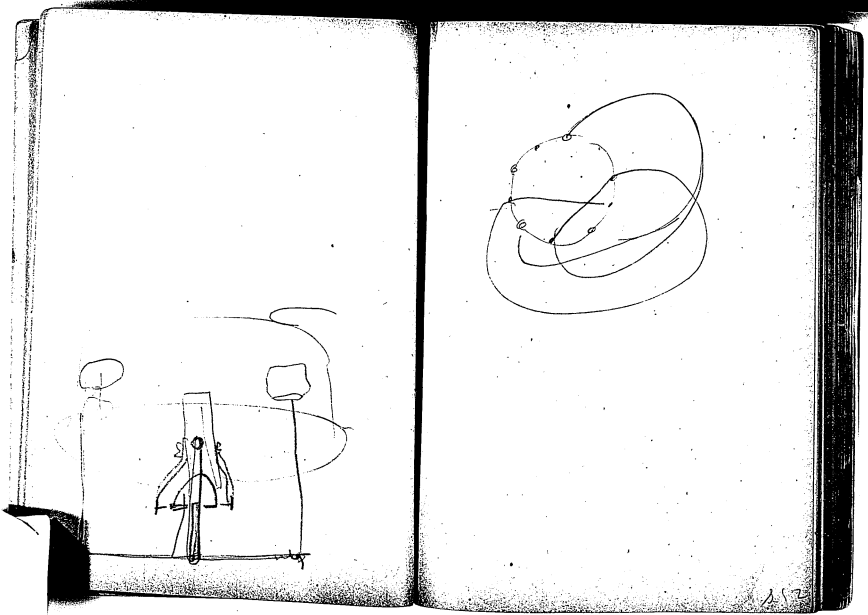




How do you get time now?


N
S





Daniel cell having 2 ohm internal and 2 daniels have ¼ ohm internal + 10 ohms outside ~~make it equal~~ for about same deflection makes it equal to a little more than 4 Daniells

Machine works very strong 700 ohms. (Coat is all !!!

Resistance of [illegible]

.46

Armature .31

.77 Ans

Use of Small Apparatus on Tangent Galvanometer —

Gun Cel on Short Circt. $3\frac{1}{4}°$
" " on 10 ohms

Machine on short circt. with 1 carbon on Field —

~~revolutions~~

231	revolutions	11°
396	"	19°
429	"	21
616	"	26
1221	"	33
1321	"	32

On 10 ohms resistance

561	revolution	1° 45′
924	"	2° 30′
1232	"	2° 45′
2012	"	1

28

56
56
616

26°

37
3
111
111
1221

33°

40
3
120
120
1320

32°

10° Ohms outside

17
3
51
51
561

1° 45'

28
3
84
84
924

2° 30'

28
4
112
112
1232

2° 45'

33
3
99
99
2012

10

192

36
36
396

1 cell Carbon

Commutator set one block ahead 396 Revolutions

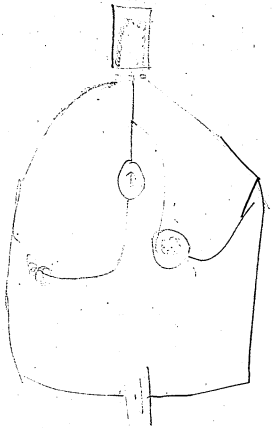
18° to 20°

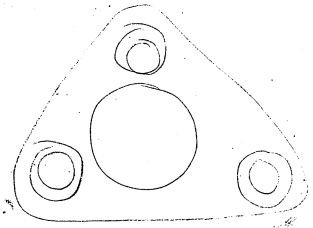
21
21
231 revolutions

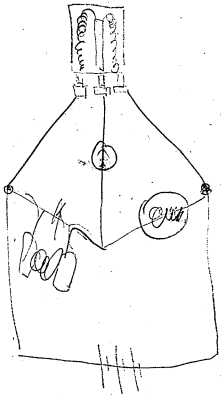
10° to 12°

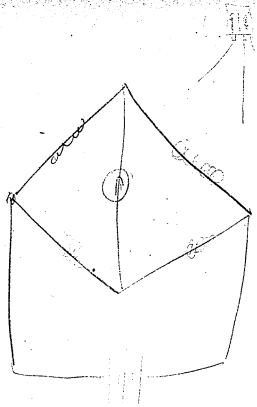
39
39
429 revolut

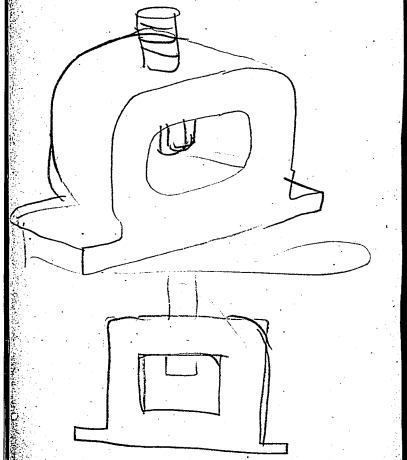
20° 22°

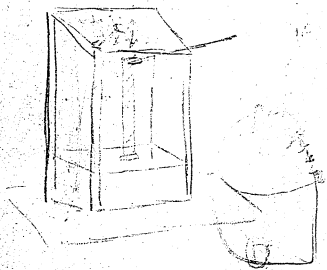












950

1000